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# REPORT ON A BACTERIOLOGICAL SURVEY ALONG THE ONTARIO SHORELINE OF THE DETROIT RIVER 1975

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Ontario
Ministry of the Environment

The Honourable
George A. Kerr, Q.C.,
Minister

Everett Biggs,
Deputy Minister

# Report on a Bacteriological Survey Along The Ontario Shoreline of the Detroit River 1975

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October 1976

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## Introduction

Bacteriological contamination along the Ontario shoreline of the Detroit River and extending into the western basin of Lake Erie has been recognized as a problem for some time (IJC, 1968 and Great Lakes Water Quality Board, 1975). Considerable progress has however been made since 1970 in controlling the discharge of untreated or inadequately treated sanitary wastes. Included among these improvements were the completion of the West Windsor sewage treatment plant in 1970 and the expansion of the Little River sewage treatment plant in 1974 to handle wastes collected by new sewerage systems serving the municipalities of St. Clair Beach and Tecumseh. The present study was intended to review progress being made in reducing the severity of contamination and to pinpoint areas where further abatement measures would be necessary.

## Study Plan

The study undertaken in 1975 consisted of three cruises - May 6-10, July 14-18 and August 15-20. Nineteen transects were used with samples being collected at 50 feet, 200 feet and 600 feet from shore (Figure 1). Samples were analyzed for total coliform, fecal coliform, fecal streptococci and pseudomonas aeruginosa counts.

A total of 0.65 inches of rain fell on the two days immediately prior to the July survey, otherwise the surveys were carried out during dry weather (Environment Canada, 1975).

Sanitary waste inputs to the river come from storm and combined overflow sewers, tributaries such as Little River, Turkey Creek and Riviere aux Canard and the West Windsor and Amherstburg Anderdon and Malden (Amherstburg) sewage treatment plants. These inputs were monitored in conjuction with the river sampling.

## Discussion of Survey Results

The distribution of total coliform, fecal coliform and fecal streptococci densities along the Ontario shoreline of the river is shown in Figures 2-4.

Fecal coliform counts are a primary indicator of the threat to public health resulting from sanitary waste inputs to a watercourse. The Ministry recreational use criterion (MOE 1974) of 100 fecal coliform organisms/100 ml was exceeded close to shore during the May and July surveys. Contamination was most extensive in July, likely as a result of rain-induced runoff, when about 20 miles of shoreline from Dieppe Park (at the foot of Ouellette Avenue in the City of Windsor) to the river mouth were found to violate the criterion.

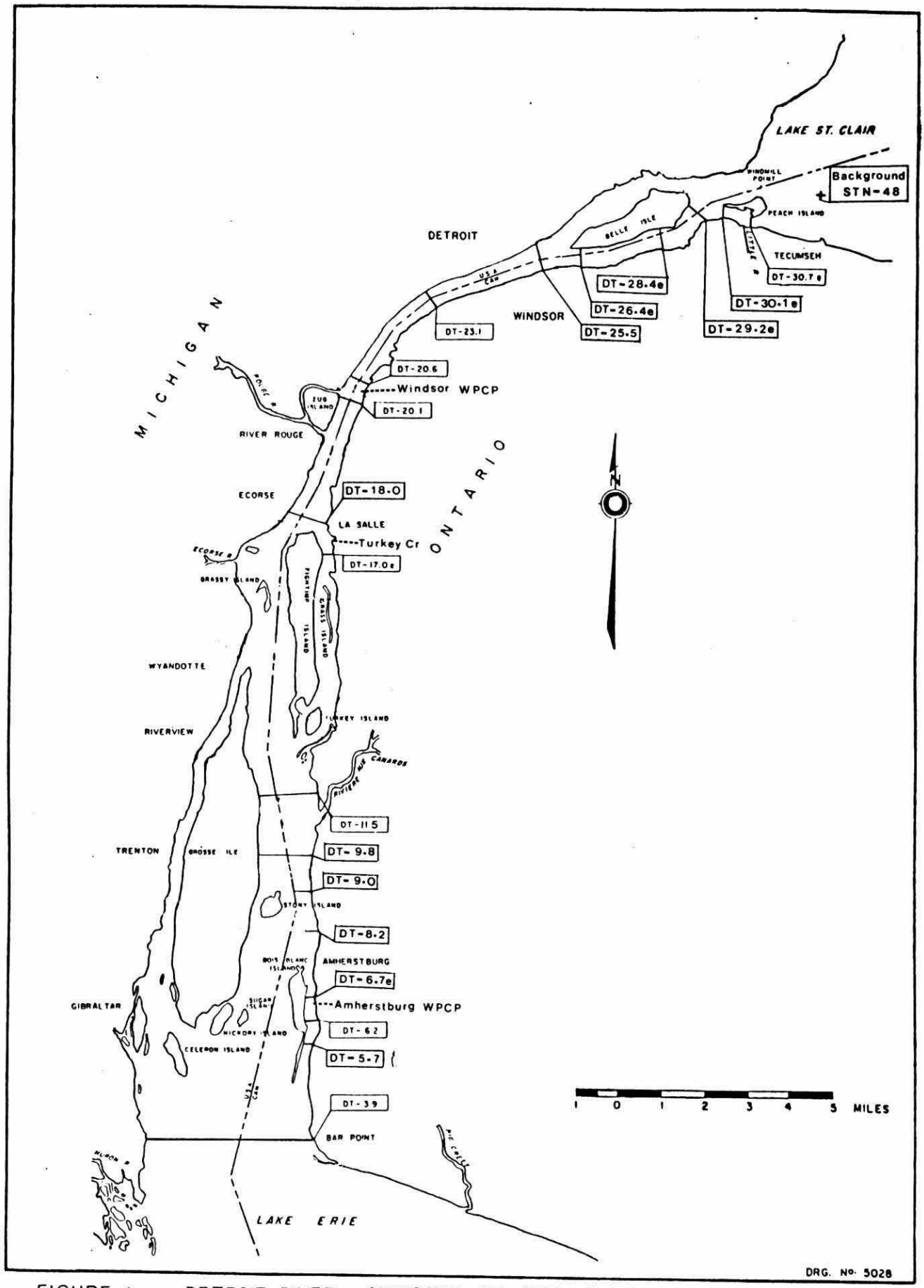


FIGURE 1 DETROIT RIVER - MINISTRY OF THE ENVIRONMENT
BACTERIOLOGICAL — MONITORING RANGES
1975

In May, fecal coliform densities exceeding the criterion were found in a 3 mile stretch of river below Dieppe Park, and also downstream of the Amherstburg sewage treatment plant outfall. In August fecal coliform levels generally complied with the criterion.

The lateral extent of contamination exceeding the Ministry fecal coliform criterion is shown in Figure 5. Only in July did violations of the criterion occur beyond 200 feet from shore showing the general confinement of wastes close to shore by the strong current.

As expected total coliform counts followed a similar pattern to the fecal coliform densities with violations of the 1000 organisms/100 ml criterion being found however during all three surveys.

Fecal streptococci counts were found to be within the 20 organisms/100 ml recreational use criteria at all locations during the May survey. In July, violations were found along a 6 mile section of the river beginning near the southern tip of Belle Isle and also downstream of the Amherstburg STP. The affected portion of the Windsor shoreline was somewhat reduced in August extending for 4 miles downstream of Dieppe Park. In the Amherstburg area a larger section of shoreline violated the criterion in August, extending from the northern end of Bois Blanc to the river mouth.

The seasonal distribution of pseudomonas aeruginosa during the study is shown in Figure 6. This pathogen of sanitary origin has been implicated in infections of the eye, ear, nose and throat. The organism was nearly absent in the river during May with low counts isolated only in the vicinity of overflow sewers in Windsor and downstream of the Amherstburg STP. Only in July did counts exceed the 1 - 10 range indicative of low level contamination as suggested by Hoadley (1968) with highest densities again occurring in the central Windsor and Amherstburg areas.

Bacterial densities measured in the effluents from the two sewage treatment plants and at the mouths of the three tributaries are presented in Table 1.

Coliform counts in the treated effluent from the West Windsor sewage treatment plant indicates that this plant is achieving an appropriate level of disinfection for a primary facility. The Amherstburg plant effluent had coliform densities more than ten times the level at Windsor, a condition which has contributed to bacterial densities in the Detroit River immediately downstream of the outfall which are the highest recorded anywhere along the Ontario shoreline.

Bacterial levels at the mouths of Little River and Riviere Aux Canard generally comply with Ministry criteria. At the Turkey Creek outlet however, all indicators exceeded criteria during all three survey periods. The ratio of fecal coliform to fecal streptococci in Turkey Creek ranged from 4 to 12. Investigations carried out by Lin et al (1974) indicated that a FC:FS ratio >4 is indicative of human wastes. There are many malfunctioning private septic tank systems in the Turkey Creek watershed (OWRC 1971).

Comparison With Earlier Years

A comparison of total and fecal coliform densities during 1975 with those observed in 1969 (total coliform only) and 1972 was made to assess the influence of abatement programs on river quality (Figure 7). The comparison is based on samples collected in July and August of each year.

The most significant alteration to bacteriological water quality is a significant improvement since 1969 in conditions downstream of Windsor, which has brought total coliform densities close to compliance with the Ministry criterion. The order of magnitude reduction in coliform levels downstream as far as Amherstburg is attributed to the completion of the West Windsor STP in 1970.

Both the fecal and total coliform data show conditions in 1975 to be similar to those in 1972 with the exception of the Amherstburg area where water quality has worsened. This problem is associated with various operational problems in addition to hydraulic overloading at the plant. The sewer separation programme in the older portion of Amherstburg is also still not completed and during heavy rains direct discharge to the river of the excess combined flow occurs.

## CONCLUSIONS AND RECOMMENDATIONS

The results of the intensive survey carried out in 1975 and a comparison of findings with earlier observations reveals that considerable improvement in water quality has been achieved over a large portion of the Ontario shoreline of the Detroit River downstream of Windsor. However, conditions in the area from Dieppe Park to the river mouth still violate Ministry recreational use criteria over the summer period.

The improvement in water quality downstream of Windsor is primarily a result of the completion of the West Windsor sewage treatment plant in 1970, which provides treatment for large areas of the city which previously discharged untreated or inadequately treated wastes to the river or watercourses draining to the river. It is, therefore, recommended that:

1. The Ministry continue to work closely with the City of Windsor to complete collection systems within those sections of the Grand Marais sewerage area which are presently served by inadequate septic tank systems and to develop programs for the collection and transfer to the West Windsor sewage treatment plant of sanitary wastes presently gaining access to the river from the Riverfront sewerage area (refer to Figure 8).

2. The Ministry continue to work with the Amherstburg, Anderdon and Malden Water Pollution Control Board to resolve the problems of hydraulic overloading and inadequate effluent disinfection at the sewage treatment plant.

3. The Ministry continue monitoring of bacteriological water quality along the Ontario shoreline of the river to assess progress in upgrading water quality to meet Ministry recreational use criteria.

REFERENCES


1. International Joint Commission Advisory Board, "Summary Report on Pollution of The St. Marys River, St.Clair River and Detroit River", September 1968.

2. Great Lakes Water Quality Board, "Great Lakes Water Quality - 1975 Annual Report", July 1976.

3. Environment Canada (Atmospheric Environment Service), "Annual Meteorological Summary 1975 - Windsor, Ontario".

4. Ontario Ministry of the Environment, "Guidelines and Criteria for Water Quality Management in Ontario," July 1974.

5. Hoadley, A.W., "On the Significance of Pseudomonas aeruginosa in Surface Waters", J.N. Engl. Water Works Assn., 1968, 82, p. 99-111.

6. Lin, S., Evans, R.L., and Beuscher, D.B. "Bacteriological Assessment of the Spoon River Water Quality," Applied Microbiology, August 1974, p. 288-297.

7. Ontario Water Resources Commission, "Water Pollution Survey (Grand Marais and Lennon Drain), City of Windsor, County of Essex", July, September, October 1971.

TABLE 1: Bacterial Densities* (org./100 ml) at Selected Sources along the Ontario Shoreline of the Detroit River

| Source | Period | Total Coliform | Fecal Coliform | Fecal Streptococci |
|---|---|---|---|---|
| Little River | May | 79 | 3 | 2 |
| | | (10-380) | (1-12) | (1-10) |
| | July | 6400 | 75 | 210 |
| | | (1900-18000) | (10-230) | (136-436) |
| | August | 4100 | 11 | 90 |
| | | (2100-1000) | (1-370) | (80-110) |
| Windsor STP Outfall | May | $5.2 \times 10^5$ | 66000 | 12000 |
| | | $(4.1 \times 10^5 - 6.6 \times 10^5)$ | | |
| | July | 9000 | 28 | 4 |
| | | | (10-2000) | (1-100) |
| | August | $11 \times 10^5$ | 1100 | >3000 |
| Turkey Creek | May | 45000 | 950 | 78 |
| | | (32000-58000) | (268-3400) | (60-110) |
| | July | 6400 | 1100 | 330 |
| | | (2600-8700) | (120-49000) | (184-688) |
| | August | 8700 | 1300 | 150 |
| | | $(31000-1.2 \times 10^5)$ | (110-4500) | (70-220) |
| Riviere aux Canard | May | 380 | 70 | 3 |
| | | (300-524) | (116-164) | (1-8) |
| | July | 1600 | 78 | 11 |
| | | (800-2900) | (40-220) | (1-60) |
| | August | 740 | 12 | 10 |
| | | (580-1100) | (1-21) | (4-20) |
| Amherstburg STP Outfall | May | $130 \times 10^5$ | $(1.1 \times 10^5$ | 380 |
| | | $(63 \times 10^5 - 220 \times 10^5)$ | | (10-14000) |
| | July | 2400 | (10-200) | (1-80) |
| | August | $140 \times 10^5$ | 71000 | >1500 |
| | | $(76 \times 10^5 - 250 \times 10^5)$ | $(10000-5 \times 10^5)$ | |

Remark* Geometric mean
(Range)

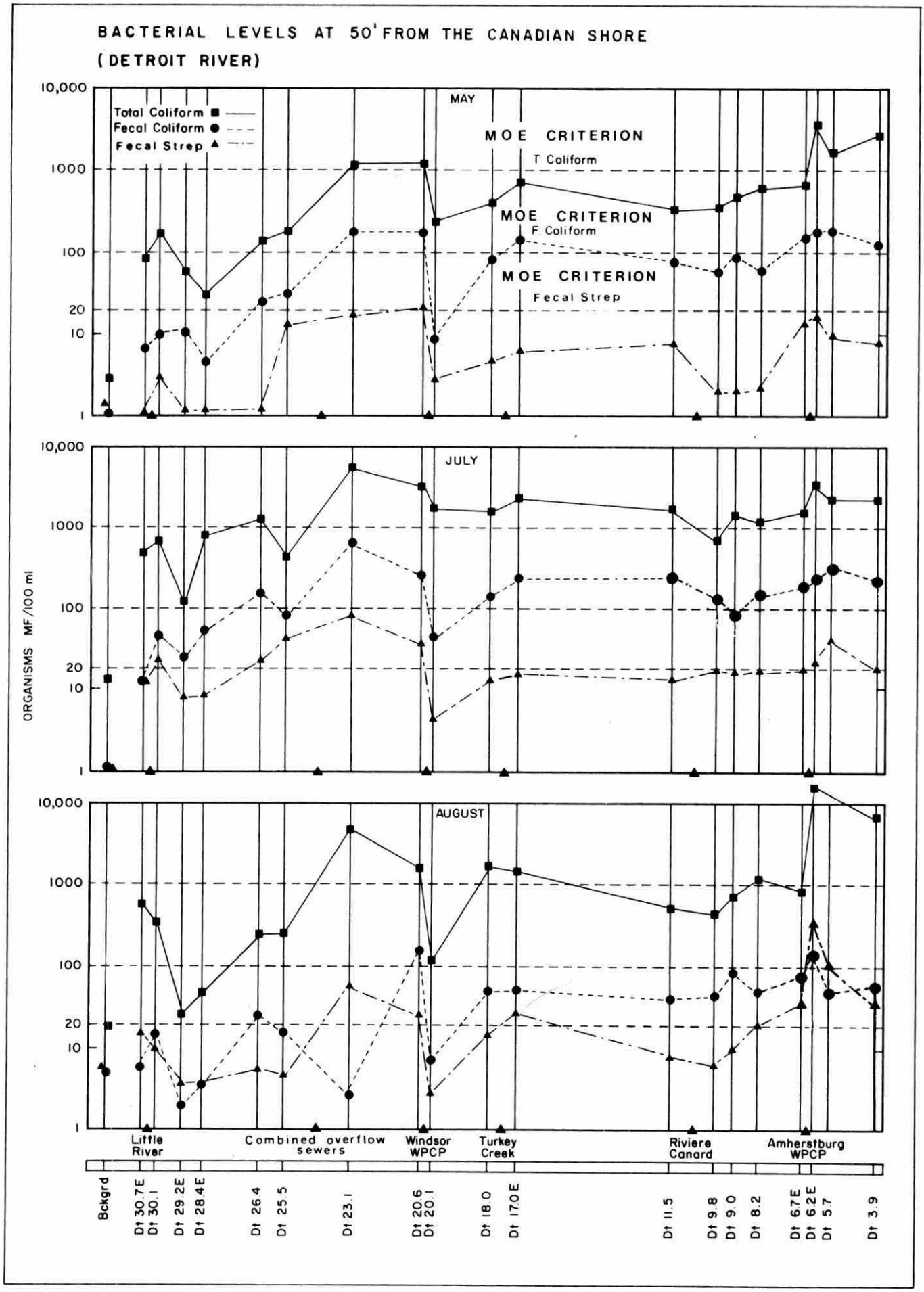
BACTERIAL LEVELS AT 50' FROM THE CANADIAN SHORE
(DETROIT RIVER)
Total Coliform
Fecal Coliform
Fecal Strep
MAY
MOE CRITERION
T Coliform
MOE CRITERION
F Coliform
MOE CRITERION
Fecal Strep
JULY
AUGUST
ORGANISMS MF/100 ml
10,000
1000
100
20
10
1
Little River
Combined overflow sewers
Windsor WPCP
Turkey Creek
Riviere Canard
Amherstburg WPCP
Bckgrd
Dt 30.7E
Dt 30.1
Dt 29.2E
Dt 28.4E
Dt 26.4
Dt 25.5
Dt 23.1
Dt 20.6
Dt 20.1
Dt 18.0
Dt 17.0E
Dt 11.5
Dt 9.8
Dt 9.0
Dt 8.2
Dt 6.7E
Dt 6.2E
Dt 5.7
Dt 3.9

FIG. 2

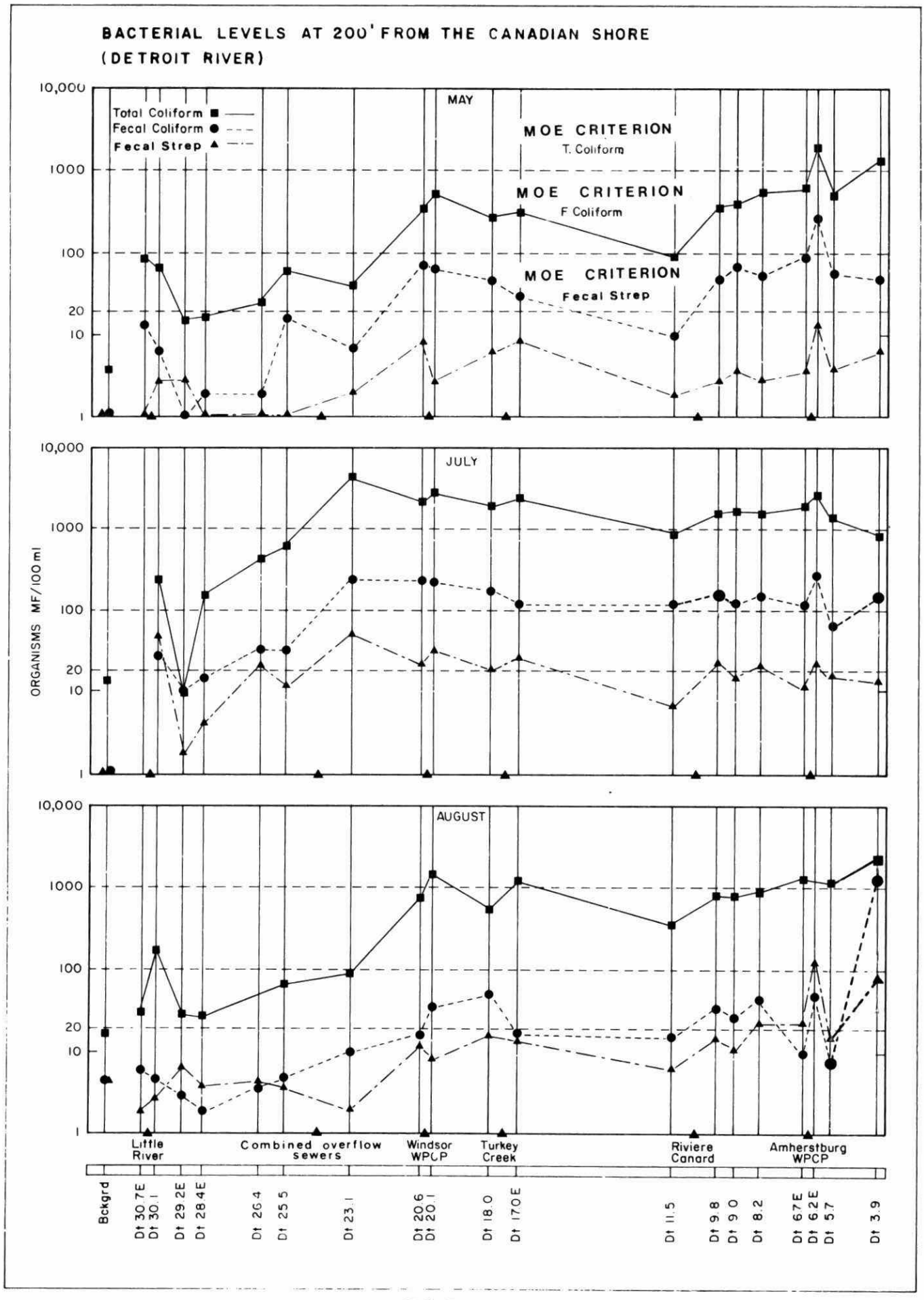
BACTERIAL LEVELS AT 200' FROM THE CANADIAN SHORE
(DETROIT RIVER)
Total Coliform
Fecal Coliform
Fecal Strep
MAY
MOE CRITERION
T. Coliform
MOE CRITERION
F Coliform
MOE CRITERION
Fecal Strep
JULY
AUGUST
ORGANISMS MF/100 ml
10,000
1000
100
20
10
1
Little River
Combined overflow sewers
Windsor WPCP
Turkey Creek
Riviere Canard
Amherstburg WPCP
Bckgrd
Dt 30.7E
Dt 30.1
Dt 29.2E
Dt 28.4E
Dt 26.4
Dt 25.5
Dt 23.1
Dt 20.6
Dt 20.1
Dt 18.0
Dt 17.0E
Dt 11.5
Dt 9.8
Dt 9.0
Dt 8.2
Dt 6.7E
Dt 6.2E
Dt 5.7
Dt 3.9

FIG. 3

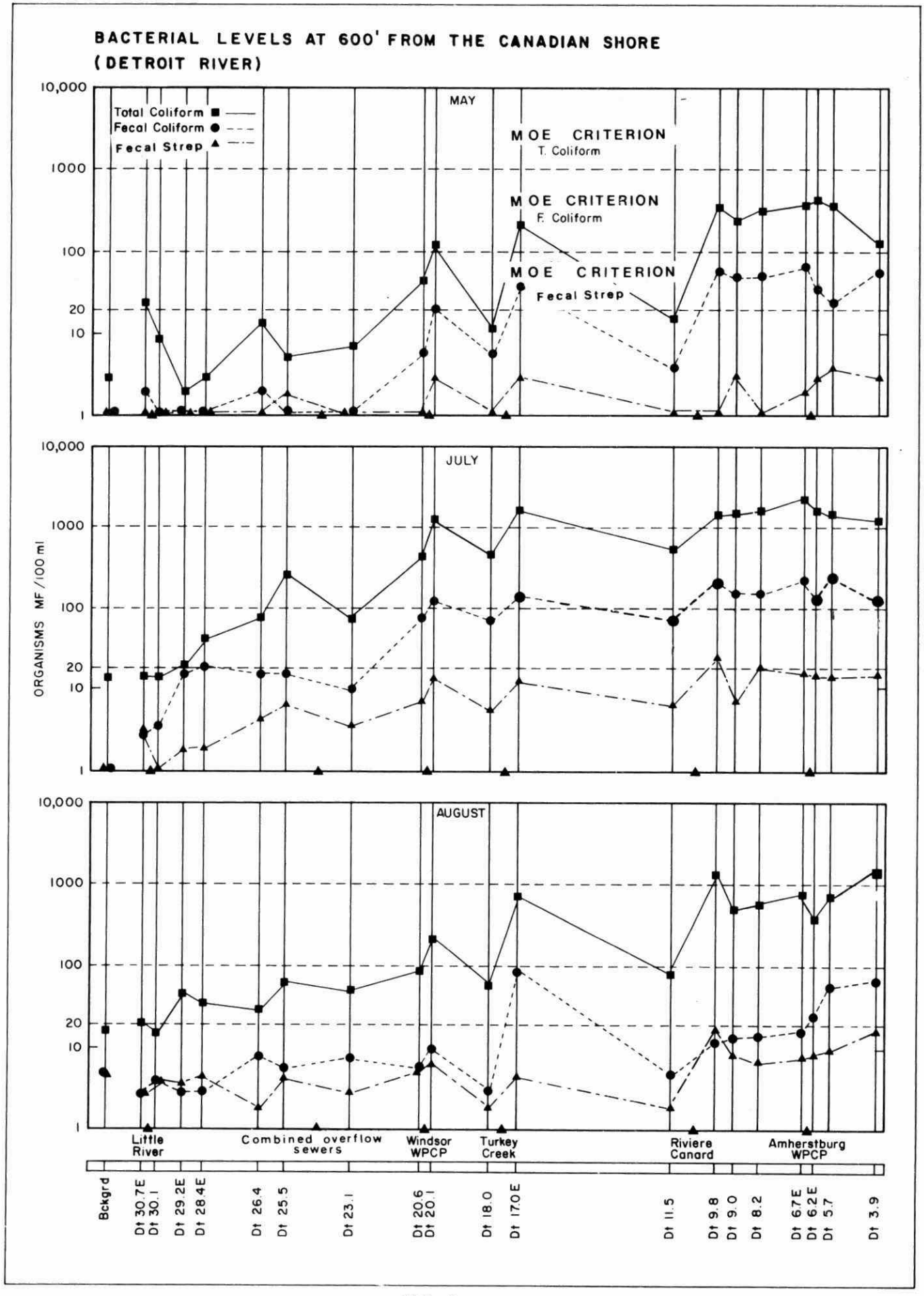
BACTERIAL LEVELS AT 600' FROM THE CANADIAN SHORE
(DETROIT RIVER)
MAY
JULY
AUGUST
Total Coliform
Fecal Coliform
Fecal Strep
MOE CRITERION
T. Coliform
MOE CRITERION
F. Coliform
MOE CRITERION
Fecal Strep
ORGANISMS MF/100 ml
10,000
1000
100
20
10
1
Little River
Combined overflow sewers
Windsor WPCP
Turkey Creek
Riviere Canard
Amherstburg WPCP
Bckgrd
Dt 30.7E
Dt 30.1
Dt 29.2E
Dt 28.4E
Dt 26.4
Dt 25.5
Dt 23.1
Dt 20.6
Dt 20.1
Dt 18.0
Dt 17.0E
Dt 11.5
Dt 9.8
Dt 9.0
Dt 8.2
Dt 6.7E
Dt 6.2E
Dt 5.7
Dt 3.9

FIG. 4

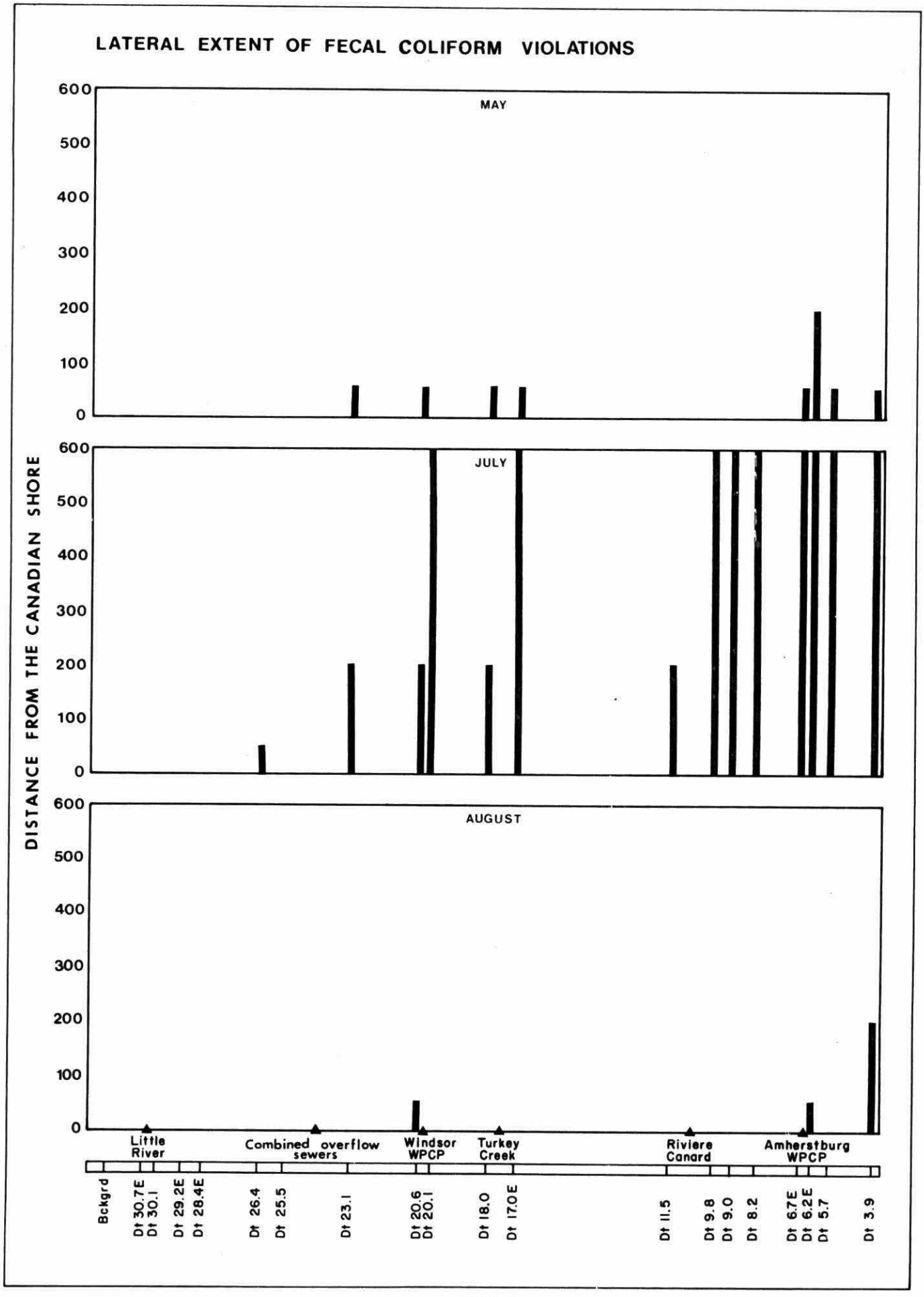
LATERAL EXTENT OF FECAL COLIFORM VIOLATIONS
MAY
JULY
AUGUST
DISTANCE FROM THE CANADIAN SHORE
600
500
400
300
200
100
0
Little River
Combined overflow sewers
Windsor WPCP
Turkey Creek
Riviere Canard
Amherstburg WPCP
Bckgrd
Dt 30.7E
Dt 30.1
Dt 29.2E
Dt 28.4E
Dt 26.4
Dt 25.5
Dt 23.1
Dt 20.6
Dt 20.1
Dt 18.0
Dt 17.0E
Dt 11.5
Dt 9.8
Dt 9.0
Dt 8.2
Dt 6.7E
Dt 6.2E
Dt 5.7
Dt 3.9

FIG.5

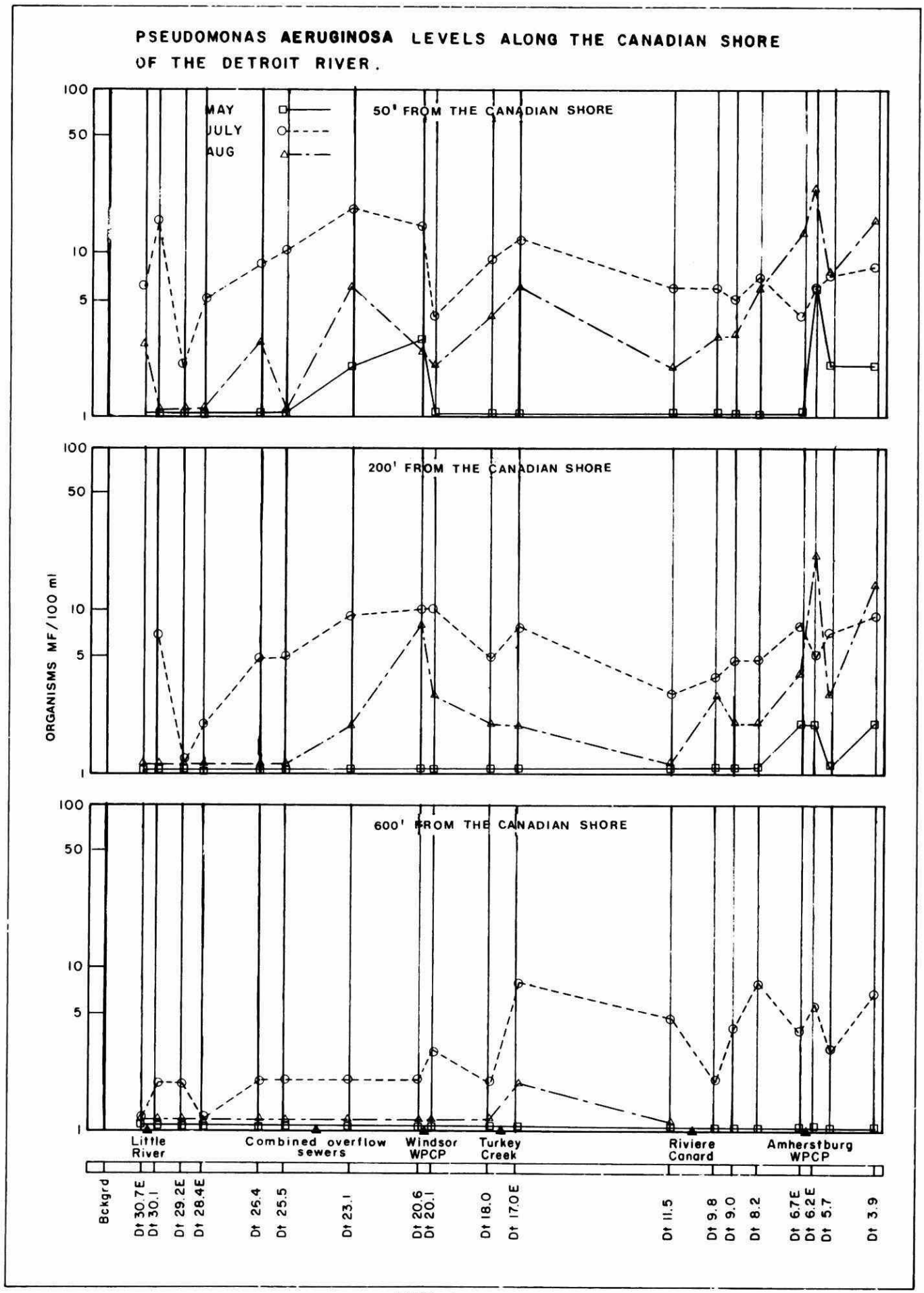
PSEUDOMONAS AERUGINOSA LEVELS ALONG THE CANADIAN SHORE OF THE DETROIT RIVER.
MAY
JULY
AUG
50' FROM THE CANADIAN SHORE
200' FROM THE CANADIAN SHORE
600' FROM THE CANADIAN SHORE
ORGANISMS MF/100 ml
100
50
10
5
1
Little River
Combined overflow sewers
Windsor WPCP
Turkey Creek
Riviere Canard
Amherstburg WPCP
Bckgrd
Dt 30.7E
Dt 30.1
Dt 29.2E
Dt 28.4E
Dt 25.4
Dt 25.5
Dt 23.1
Dt 20.6
Dt 20.1
Dt 18.0
Dt 17.0E
Dt 11.5
Dt 9.8
Dt 9.0
Dt 8.2
Dt 6.7E
Dt 6.2E
Dt 5.7
Dt 3.9

FIG. 6

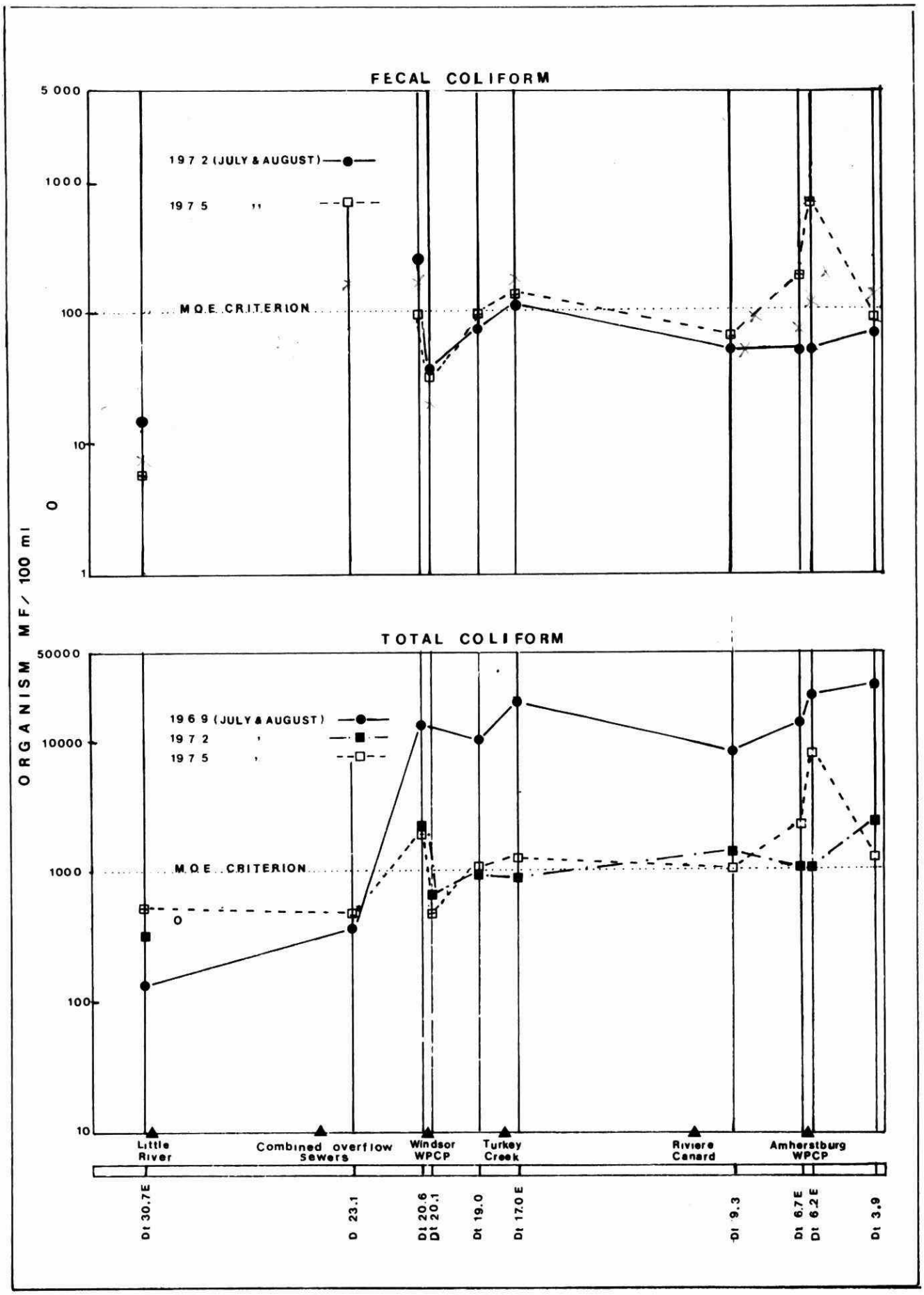


FIG. 7 YEARLY TRENDS FOR TOTAL & FECAL COLIFORM ALONG ONTARIO SHORELINE – DETROIT RIVER

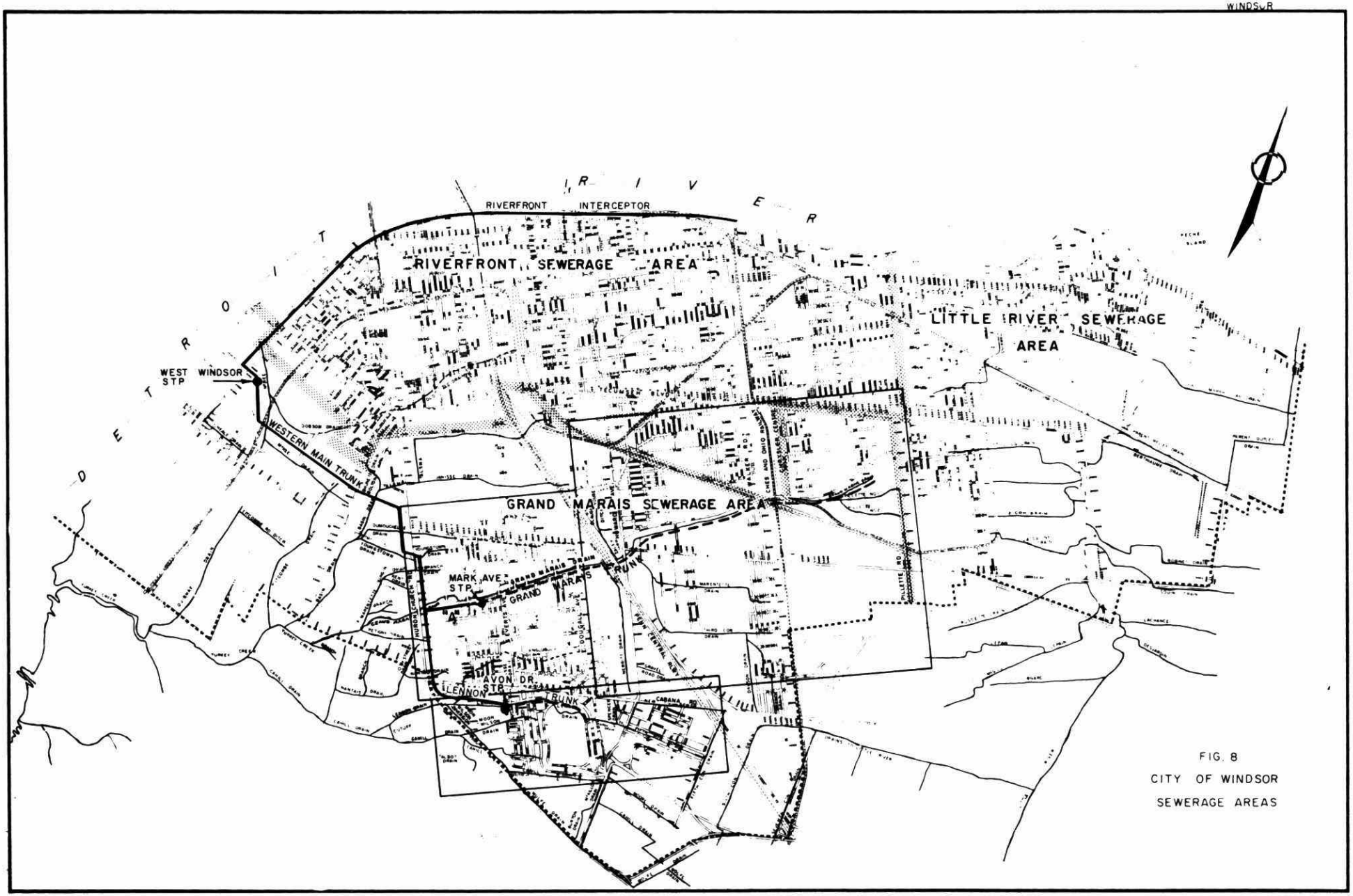


FIG. 8
CITY OF WINDSOR
SEWERAGE AREAS

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